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Components of Flex-Fuel Vehicle

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ABSTRACT

Ethanol is taken into account to be an improved fuel than fuel and is a crucial substitute, pollution free, autochthonal and price effective. The procural of plant product has seen an increase from twenty eight large integer litres to 320 large integer litres. Further, the utilization of plant product in flex-fuel vehicles also can facilitate in boosting the farming sector and generate lakhs of jobs in Asian nation. Plus, the choice to use this sort of car can cut the emission of carbonic acid gas by an oversized degree.

A flexible-fuel vehicle (FFV) or dual-fuel vehicle (called a flex-fuel vehicle) is another fuel vehicle with an indoor combustion engine designed to run on over one fuel, sometimes fuel mingling with either fermentation alcohol or methyl alcohol fuel, and each fuels area unit hold on within the same common tank. trendy flex-fuel engines area unit capable of burning any proportion of the ensuing mix within the combustion chamber as mechanical system and spark temporal arrangement area unit adjusted mechanically in step with the particular mix detected by a fuel composition detector. Flex-fuel vehicles area unit distinguished from bi-fuel vehicles, wherever 2 fuels area unit hold on in separate tanks and therefore the engine runs on one fuel at a time, for instance, compressed gas (CNG),liquefied oil gas(LPG),or H.

The new technologies to a thought of engines, that permits for the utilization of various styles of fuel. The multi-fuel engines offered within the market show just one compression magnitude relation, so being subject to improvement, on get most potency the engine should work with a variable compression magnitude relation. though technically doable, this procedure isn't thought of possible for a inexpensive product. This work proposes a system, that permits for every sort of fuel to achieve peak potency through a variance within the engine intake pressure and while not dynamic its compression magnitude relation, a feature which will be side to a coffee value product.

Introduction

I. A flexible-fuel vehicle (FFV) may be a vehicle having an enclosed combustion engine which will run on a mix of fuels, most frequently hydrocarbon and alcohol.though a flex-fuel engine will be designed to run on pure alcohol, FFVs within the U.S. area unit optimized to run on E85, a gasoline-ethanol mix with fifty one to eighty three % alcohol, consistent with the U.S. Department of Energy. the particular composition of E85 varies supported region and season to confirm that the auto will begin in weather condition. Leading automakers like General Motors, Toyota Motor Corporation, Ford Motor Company, et al. have stepped up their efforts to develop flex-fuel engines for rider and business vehicles, providing a major growth chance for the flex-fuel engine market.

II. additionally to flex-fuel vehicles running with alcohol, in Europe and also the USA, chiefly in Calif.,there are productive check programs with wood alcohol flex-fuel vehicles, referred to as M85 flex-fuel vehicles.The energy demand in our country is rising because of associate increasing economy, growing population, increasing urbanization, evolving lifestyles and rising disbursement power. regarding ninety eight of the fuel demand within the road transportation sector is presently met by fossil fuels and also the remaining two by biofuels.

III. presently gasolene with 100% alcohol mix (E10) is being retailed by varied Oil selling corporations (OMCs) in Republic of India, where it's accessible. However, as adequate amount of alcohol isn't accessible, therefore, solely around five hundredth of gasolene sold is E10 amalgamated, whereas remaining is unblended gasolene (E0). the present level of average alcohol mixing within the country is five-hitter (Ethanol provide Year 2019-20). because of many interventions within the provide aspect of alcohol, the Ministry of rock oil aims to realize 100% alcohol mixing levels within the alcohol provide Year (ESY) – 2021-22 i.e. April, 2022.

IV. Flex fuel" refers to the vehicle, not the fuel. A typical "normal" automobile will solely use straight hydrocarbon or a tenth alcohol mix (E10).

A Flex Fuel vehicle can run on a far higher share alcohol, generally up to eighty fifth (E85) within the USA, and up to 100% in another places (Brazil, for example). And it will still use straight hydrocarbon also, thus in follow a Flex Fuel vehicle will run on something from E100/E85 to "E0" (straight gasoline).

V. Bio-ethanol contains less energy per metric capacity unit than gasolene however the hot price (energy contained within the fuel) of bio-ethanol can become on par with gasolene with use of advanced technology.The government has additionally suggested carmakers to begin creating Flex Fuel robust

Hybrid electrical Vehicles (FFSHEV). Such a vehicle, tho' nonetheless to be created wide accessible in world markets, basically homes an electrical motor that powers the vehicle aboard the standard gasolene engine.

2. VEHICLE TECHNOLOGY

Flex Fuel Engine technology (FFE) is a well-accepted concept in Brazil, representing over 80% of the total number of new vehicles sold in the country (2019). The Flex fuel vehicles used in Brazil operate with E27 or E100 Hydrous ethanol or any blend between these two. The vehicle technologies for ethanol are already proven along with the compatible fuel systems globally. So, the selection and optimization of technology for the engine has to be undertaken considering the availability of fuel ethanol. The cost of flex fuel vehicles (four-wheelers) would be higher in the range of Rs 17000 to Rs 25000. The two-wheeled flex fuel vehicles would be costlier in the range of Rs 5000 to Rs 12000 compared to normal petrol vehicles.

K***ey Components of Flex Fuel Vehicle:***

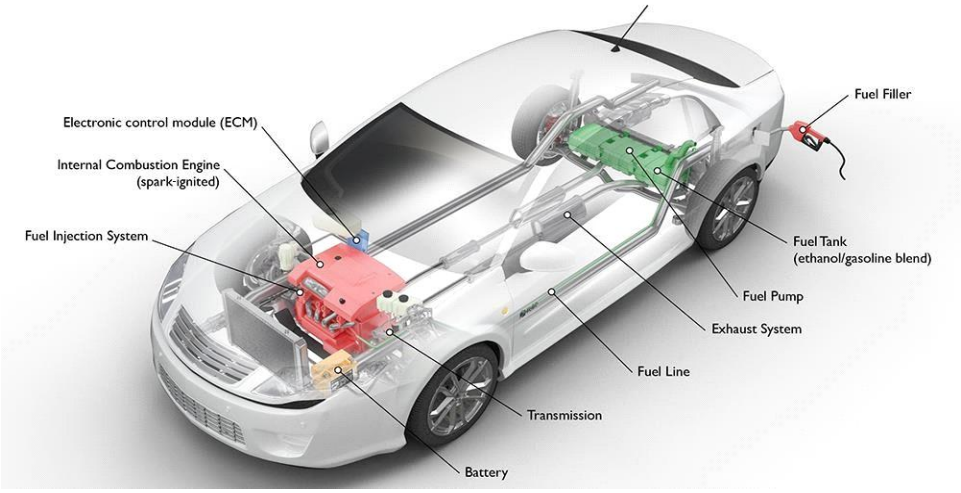

Fig. Flex Fuel Vehicle

Components of a Flex Fuel Vehicle

Battery: The battery provides electricity to start the engine and power vehicle electronics/accessories. Electronic control module (ECM): The ECM controls the fuel mixture, ignition timing, and emissions system; monitors the operation of the vehicle safeguards the engine from abuse; and detects and troubleshootsproblems.

Exhaust system: The exhaust system channels the exhaust gases from the engine out through the tailpipe. A three-way catalyst is designed to reduce engine-out emissions within the exhaust system.

Fuel filler: A nozzle from a fuel dispenser attaches to the receptacle on thevehicle to fill the tank. It should be made of anti corrosive material.

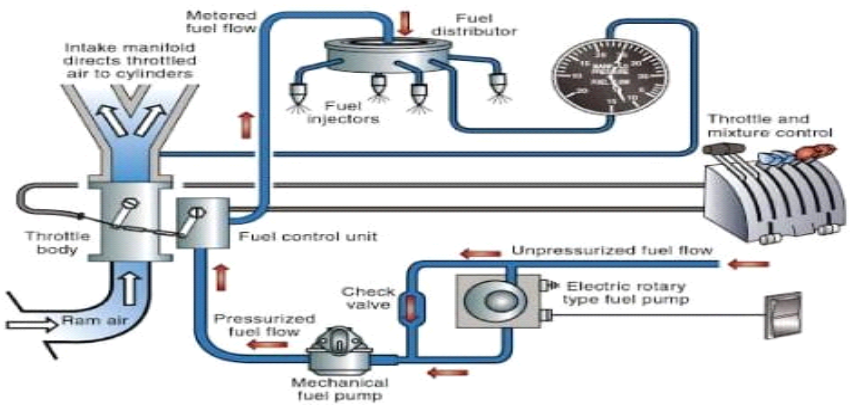

Fig. Components Of Flex Fuel Vehicle

Fuel injection system: This system introduces fuel into the engine's combustion chambers for ignition.

Fuel line: A metal tube or flexible hose (or a combination of these) transfers fuel from the tank to the engine's fuel injection system.

Fuel pump: A pump that transfers fuel from the tank to the engine's fuel injection system via the fuel line. The fuel supply pump, often referred to as the lift pump, is responsible for drawing fuel from the tank and delivering it to the high pressure pump. Modern day fuel pumps can be electrically or mechanically driven by the engine. Using an electrically driven fuel pump allows the pump to be placed anywhere in the fuel system including inside the fuel tank. Pumpsdriven by the engine are attached to the engine.

Fuel tank (ethanol/gasoline blend): Stores fuel on board the vehicle to power the engine. The fuel tank is a reservoir that holds the fuel supply and helps maintain its temperature at a level below its flash point. The fuel tank also serves as an important means of dissipating heat from the fuel that is returned from the engine [Bosch 1971]. The fuel tank should be corrosion-resistant and leakproof to pressures of at least 30 kPa. It must also use some means to prevent excessivepressure accumulation such as a vent or a safety valve.

Internal combustion engine (spark-ignited): In this configuration, fuel is injected into either the intake manifold or the combustion chamber, where it iscombined with air, and the air/fuel mixture is ignited by the spark from a sparkplug.

Pulse Control

Ethanol is less energy dense than gasoline, meaning more ethanol is needed in the combustion chamber to produce the same energy output as a gasoline only engine. To account for this, FFVs have a wider range of pulse in the fuel injection sensors allowing up to 40 percent more liquid fuel into the fuel air mixture. The sensor can detect the presence of ethanol and analyze the concentration so that it injects the proper amount of fuel for conditions.

Electronic Control Module(ECM)

These ECMs together are sometimes referred to collectively as the car's computer though technically they are all separate computers, not a single one. Sometimes an assembly incorporates several individual control modules (a PCM oftencontrols both the engine and the transmission)

The electronic engine control module (ECM) is the central controller and heart of the engine management system. It controls the fuel supply, air management, fuel injection and ignition. Due to the scalability of its performance, the control unit is also able to control the exhaust system as well as to integrate transmission and vehicle functions. The ECM manages all types of powertrain and topologies such as Gasoline, Diesel, CNG, Ethanol and also Hybrid and Fuel Cell system.

Types of ECU

With vehicles having multiple ECU they are divided on what tasks theyperform. Some of these types are as follows:

Engine Control Module

With its sensors, the ECM ensures the amount of fuel and ignition timingnecessary to get the most power and economy out of the engine

Brake Control Module

Used in vehicles with ABS, the BCM makes sure that the wheels are notskidding and determine when to trigger braking and let go of the brake to ensure the wheels don’t lock up.

Transmission Control Module

Used on an automatic vehicle, the TCM ensures you get the smoothest shifts possible by assessing the engine RPM and acceleration of the car.

Telematic Control Module

Another one with the same abbreviation this TCU ensures the car onboard services are up and running. It controls the satellite navigation and Internet and phone connectivity of the vehicle.

Suspension Control Module

Present in Cars with active suspension systems, the SCM ensures the correct ride height and optimal changes to suspension depending on the driving condition.

Fuel Injection System

The flexible fuel vehicles is built with an ethanol-ready engine and one fuel tank for both fuels. The small gasoline reservoir for starting the engine with pure ethanol in cold weather, used in earlier ethanol-only vehicles, was kept in the first generation of flexible-fuel vehicles, mainly for users of the central andsouthern regions, where winter temperatures normally drop below15 °C (59 °F).

A key innovation in the flex technology was avoiding the need for an additional dedicated sensor to monitor the ethanol-gasoline mix with fuel. This was accomplished through the lambda probe, used to measure the quality of combustion in conventional engines, is also required to tell the engine control unit (ECU) which blend of gasoline and alcohol is being burned. This task is accomplished automatically through software developed by engineers, called "Software Fuel Sensor" (SFS), fed with data from the standard sensors already built-in the vehicle.

This technology allows the controller to regulate the amount of fuel injected and spark time, as fuel flow needs to be decreased and also self-ombustion needs to be avoided when gasoline is used because ethanol engines have compression ratio around 12:1, too high for gasoline.

Working and principle of flexible fuel IC Engine :

In an IC engine, the fuel ignition process occurs inside the engine. As the combustion process takes place, the engine converts the thermal energy of the fuel into rotatory motion. The IC engine has a crankshaft, camshaft, reciprocating piston, and a fixed cylinder. An internal combustion engine works in the following way:

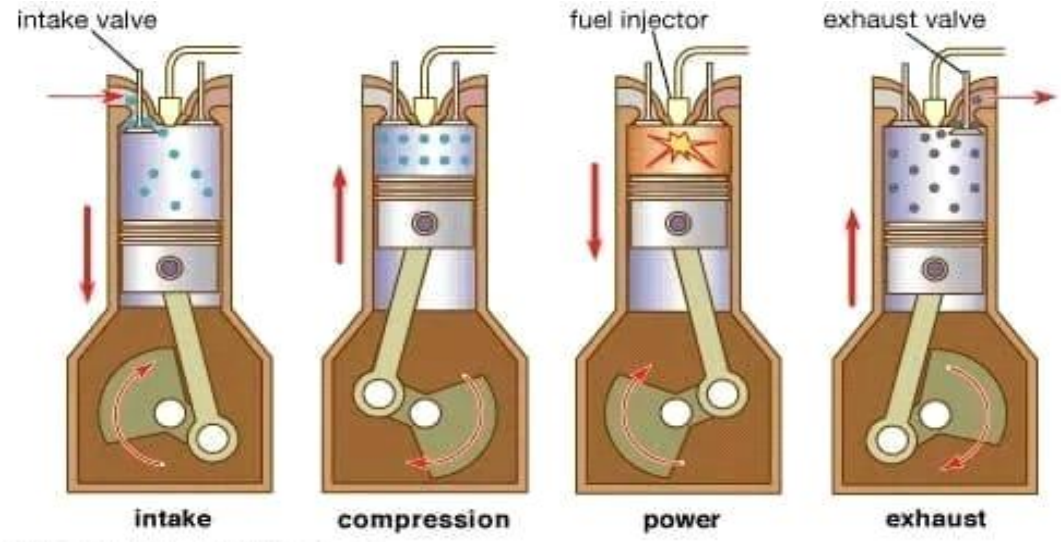

Fig. Working OF I.C. Engine

Suction Stroke: First of all, the engine sucks air from the environment into thecompression cylinder.

Compression Stroke: After the suction stroke, the reciprocating piston inside the compression cylinder compresses the air pressure and temperature. The piston compresses the air up to such high temperature that when the fuel pump injects fuel and mixes fuel with the compressed air, the air-fuel mixture ignitesitself and generates power.

Expansion/Power Stroke: The expansion stroke starts after the combustion process. In this stroke, the combusted air-fuel mixture passes through an expansion valve which expands the mixture. As the air-fuel mixture expands, it forces the piston to move up and down. The movement of the piston moves thecrankshaft, which further moves the wheels of the vehicle.

Exhaust Stroke: In this stroke, the exhaust gases are expelledthe engine cylinder, new air is introduced, and the whole cycle repeats.

Working Principle of Internal Combustion Engine

The IC engine contains a piston, combustion chamber, carburetor, connecting shaft, and crankshaft. The engine takes air from the environment and mixes it with fuel. A piston compresses the air-fuel mixture, and a spark plug provides a spark to start the combustion of the compressed air-fuel mixture. After combustion, the air-fuel mixture expands the expanding gas pushes the piston and turns the crankshaft. At last, this crank movement drives the wheels of the different automobiles through a gear system.

Regulatory Status Of Ethanol As A Fuel

The regulatory status and implementation details are as follows:

E5 [blending 5% Ethanol with 95% gasoline] was notified in 2015 by MoRT&H6. The rubber and plastic components used in gasoline vehicles produced since 2008 are compatible with E10 fuel.

E10 [blending 10% Ethanol with 90% gasoline] was notified in 2019 by MoRT&H7. The rubber and plastic components used in gasoline vehicles are currently compatible with E10 fuel.

The use of E-85 fuel (85% ethanol by volume) was notified in 2016 for 4 wheeled vehicles, 3 wheelers and 2 wheelers8. E100 [pure ethanol] for use in gasoline vehicles and ED95 [95% ethanol and 5% additives (co-solvent, corrosion inhibitors and ignition improvers)] for diesel vehicles have also been included in the same notification. The emission standards of E 85 and E 100 fuels have also been notified.

The Safety Standard (AIS 171) for various blends of ethanol with gasoline has been notified vide G S R 343 (E) dated 25th May 20219. The standard recommends material which is compatible with ethanol, viz., rubber, plastics etc. Ethanol blends increase electrical conductivity compared to gasoline, which causes corrosion of metal junctions. Therefore, the need to specify addition of corrosion inhibitors is also included. It also discusses (a) the toxic and carcinogenic nature of pure ethanol, (b) the necessity of personal protective equipment (PPE) for persons exposed to ethanol at the storage point (c) the need to have provisions for venting, flame arrestors and foam-based fire extinguishers for fighting ethanol flames. The standard also specifies labels for ethanol blends to be used in vehicles.

Production Of Ethanol Blended Petrol Compatible Vehicles

Currently produced two-wheeler and passenger vehicles in the country are designed optimally for E5, with rubber and plastic components compatible with E10 fuel; their engine can be calibrated for E10 for better performance. As the EBP rolls out in the country, vehicles need to be produced with rubberized parts, plastic components and elastomers compatible with E20 and engines optimally designed for use of E20 fuel. SIAM has assured the committee that once a road-map for making E10 and E20 available in the country is notified by MoPNG, they would gear up to supply compatible vehicles in line with the roadmap. It is possible to roll out E20 material compliant vehicles by April 2022 and E20 Engine compatible vehicles by April 2023. However, considering the supply of Ethanol Blended Fuel, it is recommended that E20 material compliant and E10 engine tuned vehicles may be rolled out all across the country from April 2023. These vehicles can tolerate 10% to 20% of ethanol blended gasoline and also give optimal performance with E10 fuel. Vehicles with E20 tuned engines can be rolled out all across the country from April 2025. These vehicles would run on E20 only and will provide high performance.

Observations:

1. As, Flex Fuel contains moisture because the Presence of Hydrogen and oxygen, all the component where fuel get in contact that will be of anti-corrosive material Like plastic or other.

2. In cold climate, we will face problem of cold starting because high ethanol concentation Hence use have to use high power spark plug, fuel pump.

3. if all vehicle runs on flex fuel, shortage of flex fuel making Crops may takes place and it will may leads to high pricing, Hence, we have to think about alternative Source Other than suger cane like corn, surplus rice, C-molasses.

4. As prices of flue are increasing, we observe that

Fuel	Prices in india	Average efficiency	Average cost/km
Flex fuel	62 Rs	17kmpl	3.64 Rs
Petrol	112.35 Rs	17kmpl	6.55 Rs
Diesel	97.25 Rs	19kmpl	5.12 Rs

If a person travels 100km per day,

Fuel	Per day(Rs)	Per month(Rs)	Per year(Rs)
Flex fuel	364	10920	131040
Petrol	655	19650	235800
Diesel	512	15360	184320

30*364 = 10920*12 = 131040

30*655 = 19650*12 = 235800

30*512 = 15360*12 = 184320

If a person travells 100 km per day then his expense on fuel for flex fuel will be 131040, For petrol is 235800 and for diesel is 184320.

If we see, a person switch from diesel vehicle to flex fuel vechile then he saves 53280 R$ and if he switch from petrol to flex fuel vehicle, then he Saves 104760. If he use flex fuel for 4 to 5 years, then he can save half of its vehicle price.

5. As petrol contains 87% carbon and diesel contains 86.2%, we have to calculate carbon percentage in ethanol.

Ethanol, C_2H_5OH at mole masses C=12,H=10,O=16

Molecular mass = 24+5+16+1 = 46

Percentage of carbon = (amount of ethanol/total amount of molar mass)*100

24/46*100

Percentage of carbon = 52.17%

As calculations,

Fuel	Carbon precent
Flex fuel	52.17%
Petrol	87%
Diesel	86.2%

As we know that, number of carbon can decide pollution percentage hence, we observe that flex fuel have 34.83% less carbon. Hence, it will be much better than petrol and diesel for environment.

6. We can also calculate carbon di-oxide emition for all of these fuels.

For diesel:

1 lit of diesel weight = 835g

As we mention, diesel contains 86.29% carbon.

For burning of 1 carbon we need 2.6667g of oxygen.

720*2.6667 = 1920g oxygen

720+1920 = 2640g of co_2/lit

An average consumption of 5 lit/100km,

= 5lit*2640g/lit/100km

= 1320g co_2/km

For petrol:

1lit of petrol weight = 750g

Petrol contains 87% carbon

It contains 652g of carbon

It need oxygen to burn carbon = 2.6667*652

= 1738.884

= 1739g

Total carbon dioxide = 652+1739

= 2391g co_2/lit

Average consumption of 5 lit/100km = 5lit*2391/100km

= 120g co_2/km

For ethanol:

1 lit of ethanol contains 789g as we calculate, it contains 52.17% of carbon

Percentage of carbon = (weight of carbon/total weight of carbon)*100

52.17 = (X/789)*100

Carbon in gram = 411.6213.

To burn 1g carbon we need 2.667g of oxygen

Totol oxygen need = 4116213+2.667

= 1097.75g

Total carbon dioxide in ethanol = 411.6213+1097.75

= 1509g co_2/lit.

An average consumption of 5 lit/100km = 5lit*(150g/100)

= 76.45g co_2/km

Fuel Flex fuel	Carbon di-oxide/km 75.4g
Petrol	120g
Diesel	132g

From table and calculations we get accurate value of emission of carbon di-oxide from vehicle per km which is harmful to environment.

CONCLUSION

Ethanol is considered to be a better fuel than petrol and is an important substitute, pollution free, indigenous and cost effective. The procurement of Ethanol has seen a rise from 28 crore litres to 320 crore litres

An FFV is a modified version of vehicles that could run both on gasoline and doped petrol with different levels of ethanol blends. These are currently being used successfully in Brazil, giving people the option to switch fuel (gasoline and ethanol) depending on price and convenience. In fact, a majority of vehicles sold in Brazil are FFVs.

For India, FFVs will present a different advantage as they will allow vehicles to use different blends of ethanol mixed petrol available in different parts of the country.

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